UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/699,188	10/27/2000	James H. Parry	21706-05327	6572

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EXAMINER
JAMAL, ALEXANDER

ART UNIT	PAPER NUMBER
2643	9

DATE MAILED: 03/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *Jan 20, 2004*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-51* is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-51* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a)☐ All   b)☐ Some * c)☐ None of:

   1.☐ Certified copies of the priority documents have been received.

   2.☐ Certified copies of the priority documents have been received in Application No. _____.

   3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Withdrawal of Rejections

1.   Examiner withdraws the Rejections of claims 1-51 from the prior office action (October

9th, 2003).

Claim Rejections - 35 USC § 112

1.   The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making
> and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it
> pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode
> contemplated by the inventor of carrying out his invention.

2.   **Claims 1-34** rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the

enablement requirement. The claim(s) contains subject matter which was not described in the

specification in such a way as to enable one skilled in the art to which it pertains, or with which

it is most nearly connected, to make and/or use the invention. Claims 1 and 22 claim a distortion

module that models the distortion of a first audio signal to create a distorted signal, and then

passes that distorted signal to an adder module that is adapted to use (subtract) said distorted

signal to remove part of the echo from a second audio signal. The applicant's specification states

that the adder module receives a signal that is an estimate of the echo (including any distortions

from the loudspeaker or microphone) and uses that signal to remove at least part of the echo of

the second signal. The adder module (as per the specification) does not receive a distorted

version of the first signal, but an estimate of the echo of the first signal (including loudspeaker

distortion) (specification page 9 lines 14-22).

Claim Rejections - 35 USC § 103

3.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
such that the subject matter as a whole would have been obvious at the time the invention was made to a person
having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
manner in which the invention was made.

4.   **Claims 35-45** rejected under 35 U.S.C. 103(a) as being unpatentable over Chu

(5263019), and further in view of Ngia et al. ('Non-linear acoustic echo cancellation using a

hammerstein model').

a.   **Claim 35:** Chu discloses a terminal for an audio communications system

comprising:

i.   A first input for receiving a first audio signal shown as S(z) and being

input to output-signal-conditioner 33 and loudspeaker 32(Fig. 1).

ii.   A second input for receiving a second audio signal from microphone 10

(Fig. 1). Wherein a portion of the second audio signal includes an echo from the

first audio signal (transmitted through speaker 32) (Col 1 lines 15-27).

iii.   An adder module 54 (Fig. 3) is used to subtract the echo estimation of the

first audio signal from the second audio signal in order to remove at least part of

the echo from the second audio signal (Col 7 line 64 to Col 8 line 15).

However, Chu does not mention a Distortion module that receives the first audio

signal and models a distortion on the first audio signal to produce a distorted signal to

which the adder module is responsive.

Ngia teaches that loudspeaker non-linearities limit the ability of the standard linear filter to approximate the actual echo signal received in an acoustic echo canceller (Page 1229, Col 2). He teaches the use of a neural net (page 1230, Col 2) (that comprises distortion modules) to model various non-linear loudspeaker distortions. This process, along with an FIR filter to model the linear dynamic portion (echo) produce the improved echo estimate that is sent to an adder to subtract the improved echo estimate from the incoming (second) signal (Fig. 1). It would have been obvious to one of ordinary skill in the art at the time of this application to provide distortion modules that take into account the non-linear distortion of the loudspeaker for the purpose of improving the accuracy of the estimated echo.

a.   **Claim 36:** Chu's system is implemented digitally (Col 3 lines 44-47). As such the first and second audio signals would inherently bear sequencing information that would be used by all parts of the system (including the adder module) for the purpose of synchronizing the input audio signals with the echo estimation signal.

b.   **Claim 37:** Ngia discloses the use of an audio generation module (the echo canceller in Fig. 1) that uses a neural net with an FIR filter to implement distortion modules that model the non-linear distortions caused by playing the first signal U(t) through a loudspeaker (pages 1229-1230).

c.   **Claims 38/39:** Ngia's audio distortion module comprises multiple distortion

modules (Page 1230 Cols 2) that each model a different type of distortion on first signal

U(t) (Page 1230 Col 1).

d.   **Claim 40:** Chu's system operates in a standard communication system (Col 1

lines 15-25), as such any distortion modules taught by Ngia must inherently alter the

modeling path with real-time responsiveness for the purpose of allowing standard, real-

time communication to occur between users of Chu's system.

e.   **Claims 41-44:** Ngia discloses the use of a Hammerstein model that models all

the non-linear distortions of playing a signal through a loudpspeaker based upon actual

data collected in an anechoic chamber (page 1230 Col 1) (Page 1231 Cols 1,2). Because

it is based upon actual experimental results, the modules would inherently model:

     i.   Amplifier clipping on the first audio signal

     ii.   Voice coil displacement on sound waves produced by the loudspeaker

     iii.   Hysteresis in iron inductors on the first audio signal

     iv.   Harmonic distortion on sound waves produced by the loudspeaker

f.   **Claim 45:** Ngia teaches the use of an FIR filter to model the linear changes in the

second audio signal (d(t) in Fig. 1) (Pages 1229-1230) based upon the acoustic echo of

the first signal.

5.   **Claims 46-51** rejected under 35 U.S.C. 103(a) as being unpatentable over Chu (5263019)

and Ngia et al. ('Non-linear acoustic echo cancellation using a hammerstein model') as applied

to claims 35-45, and further in view of Kaizer et al. (4709391).

a.   **Claims 46-48,50-51:** Chu and Ngia disclose applicant's claims 35-45, but do not specify implementing an audio sensing module (comprising multiple distortion modules that each implement a separate type of distortion) to model the non-linear distortions on the second signal received by the microphone. The distortions include:

    i.   Microphone center-clipping on the second audio signal

    ii.   Amplifier zero crossing distortion on the second audio signal

Kaizer teaches that both electroacoustic (loudspeakers) and acoustoelectric (microphones) (ABSTRACT) may be modeled with a non-linear network comprising multiple distortion modules (each one modeling a different distortion transfer function) (Col 12 line 13 to Col 13 line 13). He teaches that the model structure will may be used in systems to help reduce the distortion inherent to the transducers (both microphones and loudspeakers and take into account any amplifier clipping (Col 1 lines 33-60). It would have been obvious to one of ordinary skill in the art at the time of this application that the microphone (and any associated amplifiers) could be modeled for the non-linear distortions, and those distortions used in the echo canceller structure in addition to modeling the loudspeaker distortions for the purpose of further reducing the non-linear distortions in the system.

b.   **Claim 49:** Chu's system operates in a standard communication system (Col 1 lines 15-25), as such any distortion modules taught by Ngia or Kaizer must inherently

alter the modeling path with real-time responsiveness for the purpose of allowing

standard, real-time communication to occur between users of Chu's system.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Alexander Jamal whose telephone number is 703-305-3433. The

examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Curtis A Kuntz can be reached on 703-305-4708. The fax phone numbers for the

organization where this application or proceeding is assigned are 703-872-9306 for regular

communications and 703-872-9315 for After Final communications.

DUC NGUYEN
PRIMARY EXAMINER

AJ
March 8, 2004